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ABSTRACT

The stability of teacher behavior has been one of the most important areas of process-product research. This study was designed to investigate teacher stability in the context of math instruction across classes and times of observation in order to assess the relationship between teaching styles and student learning outcomes. Specifically the study examines: the setting, purpose, and nature of the classroom interactions of a group of middle school mathematics teachers; the stability of mathematics teachers' instructions across classes and time of observations; and the consistency of teacher instruction over a period of time. Subjects (N=62) were mathematics teachers from 5 middle schools in a metropolitan school district in the Central South who taught at a single grade level (grade 6, 7, or 8) during the observed school year. Data were collected through use of the Teacher Roles Observation Schedule (TROS) which documents observed teacher behaviors in the context of ongoing classroom instructional-learning processes. Results offer the following insights into the classroom process: (1) interactions with students were mostly instructional, sometimes managerial; (2) explaining, questioning, and commenting to the whole class were frequently utilized; (3) the task's process was emphasized more than the product; and (4) classrooms became more active over time as teachers and students came to know each other better. It was also found that teacher stability decreased over the long term, and that teachers directed classroom instruction with considerable flexibility. (LL)

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Stability of Teachers' Classroom Instruction Across Classes and Time of Observation

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Stability of Teachers' Classroom Instruction Across Classes and Time of Observation

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The stability of teacher behavior has been one of the most important areas of process-product research. Researchers have conducted studies of the consistency of teacher instruction over a period of time to associate teaching style with student learning outcomes, or to provide an insight into classroom interactions (Gall & Gersten, 1987; Guthrie & Fisher, 1983; Meyer, Linn, & Hastings, 1991; Nelsen & Ray, 1983; Pelsma, 1987; Rogasa, Floden, & Willet, 1984; Spaulding, 1982; Stodolsky, 1984). The latter approach is the one incorporated in the present study which examines the setting, purpose, and nature of classroom interactions of a group of middle school mathematics teachers.

Teaching is a complex, challenging, multifaceted process still inadequately understood (Good & Biddle, 1987). Empirical information about the classroom instructional process increases the understanding of teaching and is crucial to the improvement of education. Some of the previous research found teachers' behaviors are rather stable over time whereas some did not. For example, Young's (1980) high inference ratings of 7th and 8th

grade classes produced the strongest and most consistent stability coefficients. In contrast, Schempp's (1984) time series analysis of stability in the gym concluded that teaching behavior fluctuated in unpredictable patterns. This discrepancy may be due to differences in design, instrument and argument. Little research, however, focused primarily on the stability of middle school mathematics teachers' instruction.

The purpose of the present study is to investigate the stablility of math teachers' instruction across classes and time of observations. More specifically, this study addresses the following three questions:

(1) Are math teachers consistent in their classroom interactions observed concurrently with different classes?

(2) Are math teachers consistent in their classroom interactions over a long time with the same class?

(3) Are math teachers consistent in their classroom interactions over time across classes?

Methodology

Subject

The subjects were 62 mathematics teachers from five middle schools of a metropolitan school district in the Central South. Each teacher taught at a single grade level during the observed school year. The distribution of teachers among grade levels was fairly equal. About 21 of the teachers taught 6th grade, 20 taught 7th grade and 21 taught 8th grade. About 32 teachers were

certified as elementary teachers, and 30 as secondary teachers. A great majority, 51 (82%), of these teachers was female; and 11 (18%) were male. Three teachers were black, three were hispanic, and 56 were white.

Instrument

The instrument used for data collection was the Teacher Roles Observation Schedule (TROS) developed by Waxman and others (Waxman, Wang, Lindvall, & Anderson, 1988). The TROS is a systematic observation schedule designed to document observed teacher behaviors in the context of ongoing classroom instructional-learning processes. Teachers are observed with reference to (a) their interaction with students, others, or aides; (b) the setting in which observed behaviors occur; (c) the types of content with which they are working; and (d) the specific types of behaviors they are using. This low inference measuring instrument has been found to be reliable and valid in previous studies. Its reliability coefficient for the present study is .77.

Each teacher is observed for approximately eight 30-second intervals during a complete class period. The frequencies of interactions for the eight (or nine) sweeps of each observation period were added together and equated to 10 sweeps. The mean interaction frequency of the group of teachers for each item was computed. Any mean lower than 1.0 was considered incidental and negligible. Thus the 25 items with mean frequency over 1.0, out of 43 items in all, were included as the data base for the

present study.

Four trained observers were used. All were graduate students. The observer reliability was measured by having two independent observers simultaneously record the same class. Their responses on each sweep were matched with each other to calculate the coefficient of agreement. The observer reliability coefficients were consistently above .80: .96 for the subject of interaction, .99 for the setting, .81 for the purpose, and .84 for the nature of interactions. The overall observer reliability for the 25 items was .85.

Procedures

Each teacher was observed four times, twice during the Fall semester and twice during the following Spring semester. The two observations for the same semester were arranged as closely in time as possible. For the convenience of discussion, the first observation in the Fall semester is abbreviated as F1, the second observation as F2, the first observation in Spring as S1, and the second as S2.

Although each teacher was informed of the date they would be observed, none of the teachers knew the specific purpose of the observation. Precautions were also made to observe regular classroom instructional processes. A total of 248 observations of 62 teachers were completed.

Teacher stability coefficients were obtained by computing a Pearson product moment correlation between observations. The correlation coefficients between F1 and F2, and between S1 and S2

were examined to determine if teachers do the same thing in different classes of students at approximately the same time. The correlation coefficients between F1 and S1, and between F2 and S2 were examined to determine if teachers do the same thing to the same class of students at different times. Finally, the correlation coefficient of the average of F1 and F2 and the average of S1 and S2 was examined to determine if teachers' behaviors were comparable over a long period of time.

A multivariate analysis of variance (MANOVA) was employed to determine if teachers' background, (i.e., grade level taught and certification level) have significant effects on the observed frequency of interactions of the 25 items. The MANOVA results revealed that there were no overall significant effects of grade level taught, or certification level on the teachers' instructional interaction frequencies aggregated over the four observations.

Results

Descriptive Statistics

Descriptive statistics results of the 62 teachers' instructional interactions provide a quick overview of what was generally occurring in the classroom. Table 1 reports the means and standard deviations of the 62 teachers' average interaction frequencies in the four observations.

In general, teachers interacted instructionally (M=6.59, SD=1.44) with students much more often than managerially (M=2.42,

SD=1.20). They usually faced the whole class (M=6.56, SD=1.85) and occasionally traveled (M=1.23, SD=.97) or sat at their desks (M=1.14, SD=1.14). Their purpose of interaction focused largely on the task's process (M=4.33, SD=1.44) rather than task's content (M=1.44, SD=1.05) or product (M=2.23, SD=1.01)

At least once out of 10 sweeps the teachers (a) determined the difficulty of the task, (b) restructured specific learning tasks, and (c) redirected student thinking. At least twice they (a) communicated the task procedures/directions, (b) checked students work, and (c) responded to students' signal.

Teachers interacted not only cognitively with students but also affectively. More than once they (a) showed that they were interested in students' work, (b) encouraged students to succeed, (c) praised students' performance, and (d) corrected student behavior.

The most frequently observed nature of interaction was explaining (M=6.71, SD=1.53), followed, in descending order, by commenting (M=5.70, SD=1.36), questioning (M=3.79, SD=1.34), modeling (M=3.42, SD=1.36), demonstrating (M=2.70, SD=1.28), and cuing or prompting (M=1.91, SD=1.34).

A comparison of the average Fall and Spring observations revealed that interaction frequencies increase over time, particularly in the following items: (a) focusing on the task's process, (b) checking student's work, and (c) using questioning, explaining, listening and modeling for interactions.

Table 1

Means and Standard Deviations of Teachers' Average Instructional Interactions of the Four Observations

	M	SD
Interaction		
1. With students/Instructional	6.59	1.44
2. With students/Managerial	2.42	1.20
Setting		
1. Teacher's desk	1.14	1.14
2. Whole class	6.56	1.85
3. Traveling	1.23	0.97
Purpose of Interaction		
1. Focus on the task's content	1.44	1.05
2. Focus on the task's product	2.33	1.01
3. Focus on the task's process	4.33	1.44
4. Communicate the task's procedures/ directions	2.61	0.80
5. Determine the difficulty of the task	1.08	0.73
6. Restructure specific learning task	1.32	1.10
7. Redirect student's thinking	1.25	0.88
8. Check student's work	2.26	1.25
9. Respond to student signal	2.04	1.02
10. Show interest in student's work	1.34	1.01
11. Encourage students to succeed	1.01	0.91
12. Praise student performance	1.02	0.92
13. Correct student behavior	1.58	1.20
Nature of Interaction		
1. Questioning	3.79	1.34
2. Explaining	6.71	1.53
3. Commenting	5.70	1.36
4. Listening	2.97	1.36
5. Cueing or prompting	1.91	1.34
6. Demonstrating (visual aids and/or psychomotor)	2.70	1.28
7. Modeling (verbalization of processes)	3.42	1.36

Stability Coefficents

Table 2 reports the correlation coefficients of instructional interactions at approximately the same time for different classes. A total of 57 teachers were observed in different classes concurrently. Between the two fall observations, there were significant positive moderate correlations in teachers' (a) interacting with students either instructionally or managerially, (b) focusing on the task's process, (c) responding to student signals, (d) encouraging students to succeed, (e) listening, and (f) cuing or prompting student responses. These coefficients ranged from .32 to .44.

Between the two spring observations, there were significant positive correlations in teachers' (a) interacting with students either instructionally or managerially, (b) sitting at the teacher's desk, (c) facing the whole class, (d) restructuring specific learning tasks, and (e) praising student performance. These coefficients ranged from .28 to .45. Significant negative correlations were found in teachers' use of commend and demonstration. Coefficients were -.35 and -.27 respectively. The two items which demonstrated consistent significance were teachers' interactions with students instructionally and managerially.

Table 2

Correlations of Teachers' Instructional Interactions During the Same Time with Different Classes

	Spring Semester F1 & F2 (n=57)	Fall Semester S1 & S2 (n=57)
Interaction		
1. With students/Instructional	.35**	.28*
2. With students/Managerial	.36**	.36**
Setting		
1. Teacher's desk	.14	.35**
2. Whole class	-.08	.45***
3. Traveling	.08	.04
Purpose of Interaction		
1. Focus on the task's content.	-.03	.18
2. Focus on the task's product	.08	.11
3. Focus on the task's process	.44***	.22
4. Communicate the task's procedures/ directions	-.09	-.11
5. Determine the difficulty of the task	.07	-.05
6. Restructure specific learning task	.21	.28*
7. Redirect student's thinking	-.12	.14
8. Check student's work	.01	.11
9. Respond to student signal	.32*	.02
10. Show interest in student's work	.03	.18
11. Encourage students to succeed	.32*	.10
12. Praise student performance	.21	.38**
13. Correct student behavior	.12	.20
Nature of Interaction		
1. Questioning	.21	.25
2. Explaining	.00	.22
3. Commenting	.17	-.35**
4. Listening	.39**	-.24
5. Cueing or prompting	.36**	.08
6. Demonstrating (visual aids and/or psychomotor)	-.03	-.27*
7. Modeling (verbalization of processes)	.17	.11

*p<.05; **p<.01; ***p<.001.

Table 3 reports the correlation coefficients of instructional interactions at different times within a class as well as across classes. While 28 teachers were observed with the same class at the first observation administered in the Fall (F1) and in the following Spring (S1), only 17 teachers were observed with the same class at the second observation of Fall (F2) and Spring (S2).

Correlation results indicated that between F1 and S1 observations, two items had significant positive moderate coefficients: (a) restructuring specific learning tasks, and (b) checking student work. Coefficients were .50 and .45 respectively. Between F2 and S2 observations, there was a significant positive moderate correlation in teachers' redirecting student thinking (.54) and a significant negative moderate correlation in teachers' interacting with students instructionally (-.59). Because of the relatively small sample size, a few items with moderate coefficients, such as focusing on the task's content, cuing or prompting, appeared not to be significant statistically.

When the Fall and the Spring interaction frequencies for all classes were averaged and then correlated, significant coefficients were found in teachers' (a) facing the whole class, (b) traveling, (c) focusing on the task's content, and (d) communicating the task's procedures/directions. Coefficients of the four items were .31, .33, .26 and .25 respectively.

Table 3

Correlations of Teachers' Instructional Interactions During Different Times

	With the Same Class F1 & S1 (n=28)	F2 & S2 (n=17)	Across Classes Fall & Spring (n=62)
Interaction			
1. With students/Instructional	.09	-.59*	-.07
2. With students/Managerial	.36	-.44	.11
Setting			
1. Teacher's desk	.08	-.01	.00
2. Whole class	.12	.30	.31*
3. Traveling	-.04	.29	.33**
Purpose of Interaction			
1. Focus on the task's content	.08	.47	.26*
2. Focus on the task's product	-.08	-.43	-.05
3. Focus on the task's proces	.01	-.15	.01
4. Communicate the task's procedures/direction	-.06	-.33	-.25*
5. Determine the difficulty of the task	.02	.22	.15
6. Restructure specific learning task	.50**	.05	.18
7. Redirect student's thinking	.21	.54*	.11
8. Check student's work	.45*	.29	.20
9. Respond to student signal	-.33	-.18	-.04
10. Show interest in student work	.27	.24	.20
11. Encourage students to succeed	.27	-.07	.09
12. Praise student performance	.28	.29	.24
13. Correct student behavior	.20	.08	.22
Nature of Interaction			
1. Questioning	-.24	-.05	-.02
2. Explaining	-.04	.09	.06
3. Commenting	.01	.20	.02
4. Listening	.19	.25	.14
5. Cuing or prompting	.13	.47	.21
6. Demonstrating (visual aids and psychomotor)	.29	.04	.12
7. Modeling (verbalization of processes)	.21	-.01	.02

*p<.05; **p<.01; ***p<.001.

Discussion

The results of the present study provide some useful information about the classroom instructional process. Middle school mathematics teachers interacted with students mostly instructionally and sometimes managerially. Teachers often used explaining, questioning and commenting to the whole class. They emphasized the task's process more than the product. Their classrooms became more active over time as teachers and students came to know each other better.

The results also produced a few significant correlations. In general, more significant stability coefficients were found in interactions observed concurrently in different classes than in those observed over a long time either within or across classes. This trend confirms the previous research finding that teacher stability decreases over a long time.

The correlation results also support previous research findings that teachers directed classroom instruction with considerable flexibility. Correlations of the 25 items varied in both directions, ranging from zero to moderate correlations. Rank median coefficients range from .14 to .20. Teachers' instructional and managerial interactions with students observed concurrently were the only items with consistent significant correlations among the five sets of correlations. Possible explanations for the absence of strong and consistent correlations over time are abundant. Shavelson and Dempsey-

Atwood (1976) mentioned four possible sources of instability; (a) systematic and/or random changes in teaching behavior over time, (b) systematic and/or random differences in teaching from one situation to the next, (c) systematic differences between pupils taught from one time to the next, and (d) limitations in measurement methods. Young (1980) suggested that low inference measures yield lower coefficients than high inference measures.

In addition, specific mathematics content and level of content difficulty may contribute to the differences in teaching behavior, In this study, all 62 teachers taught one single grade level. It is reasonable to assume that the content covered during approximately the same time would be similar for different classes of the same teacher. This may also explain why there were more significant correlations between different classes observed concurently than those observed in the same class over time. The variations in academic content and level of content difficulty were found to be associated with variations in effective teaching style (Evertson & Weade, 1989).

Other factors not included in the present study may be partially responsible for the results, such as teaching experience, teacher's major, certain uncontrolled classroom conditions, and so forth. Future research may include these variables, take different approaches, and/or use differnt instruments to provide a comprehensive understanding of teaching and teacher stability. For example, future research may study the differences among individual teachers which impact their

teaching stability, or compare the results generated from high inference and low inference instruments of the same observation.

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